SEPTEMBER 1999

AIR RESOURCES BOARD

STANDARD OPERATING PROCEDURE FOR THE CERTIFICATION AND VERIFICATION OF OZONE PRIMARY AND TRANSFER STANDARDS USING THE STANDARD REFERENCE PHOTOMETER

MLD METHOD 5720

QUALITY MANAGEMENT AND OPERATIONS SUPPORT BRANCH
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TABLE OF CONTENTS

1. INTRODUCTION

1.1 This standard operating procedure describes the certification of ozone transfer standards and verification of ozone primary standards. Ozone standards are required for the calibration and auditing of ambient ozone monitors.

1.2 This procedure uses Standard Reference Photometer (SRP) #4 to measure ozone levels. The SRP #4 was manufactured by the National Institute of Standards and Technology (NIST). The SRP is owned by the U.S. EPA, however, it is operated by the Standards Laboratory.

1.3 This procedure will determine the client's primary or transfer standard's ability to accurately measure levels of ozone. The client's instrument response is compared to the SRP's response to levels of ozone.

2. SUMMARY OF METHOD

2.1 METHOD NOMENCLATURE

2.1.1 Calibration - establishes a correction factor to adjust or correct the output of an instrument. This is determined through a comparison between an instrument and the SRP at varying levels of ozone.

2.1.2 Certification - establishes traceability of a transfer standard to the SRP. The certification of an instrument requires the results of six calibrations to meet requirements established by the U.S. EPA. Specific criteria are outlined in Reference 9.1.

2.1.3 Verification - establishes comparability of a primary standard to the SRP. The verification of an instrument requires the results of one calibration to meet requirements established by the U.S. EPA, however, the output of the instrument is not to be corrected based upon the results of the calibration. Specific criteria are outlined in Reference 9.2.

2.1.4 Transfer standards – a transportable device or apparatus that is capable of accurately producing or assaying ozone concentrations. These types of instruments undergo certification process. An instrument can be used as a transfer standard if meets the requirements defined in Reference 9.1.

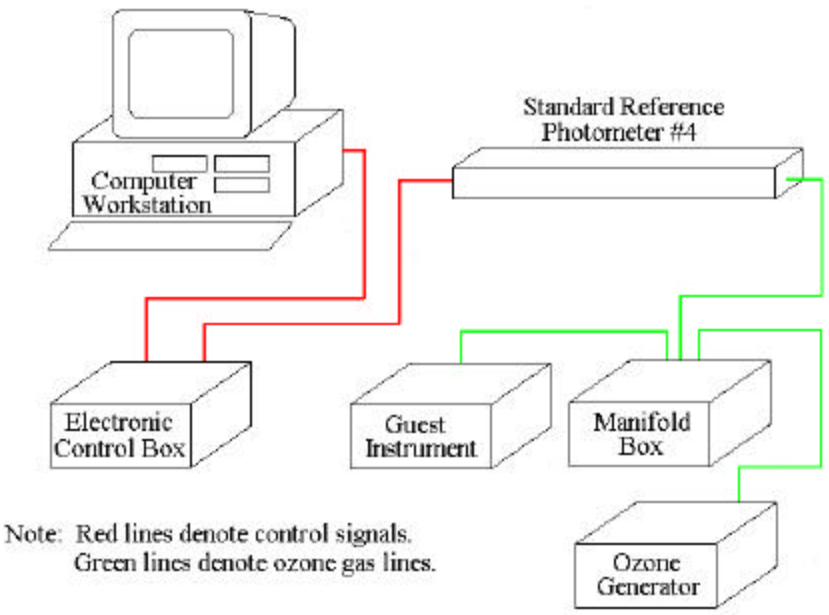
2.1.5 Primary standards – a device capable of assaying ozone concentrations by UV photometry in accordance with the Code of Federal Regulations, part 50, Appendix D (40CFR50). Essentially, these types of instruments are ozone photometers that require a source of reference gas separate from sample gas (including purified sample gas). Agencies are encouraged to intercompare primary standards to SRPs as part of their routing quality assurance programs. These types of instruments undergo the verification process.

2.2 ANALYSIS METHOD

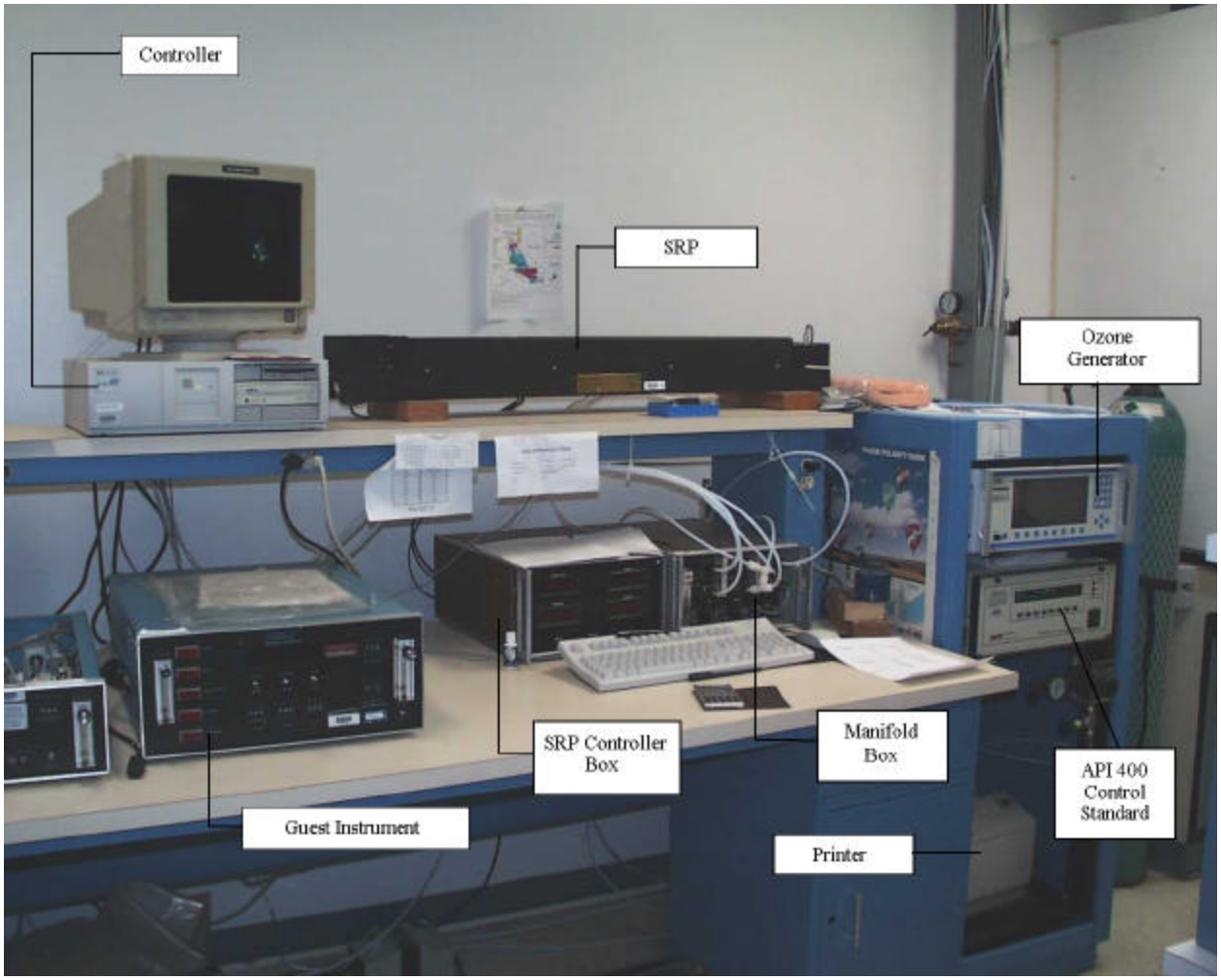
2.2.1 This method of assaying ozone is based upon the tendency for it to absorb light at a specific wavelength (254 nanometers). The amount of light absorbed is directly proportional to the amount of ozone present. The physical basis of photometry is described in Section 2.1 of Reference 9.2.

2.2.2 The SRP introduces a clean gas (reference gas) into the photometer and measures the amount of light at 254 nm pass through it. Then, a sample gas is introduce and the amount of light passed is measured. Based upon the previously mentioned variables, an ozone concentration can be calculated. A detailed theory of operation is explained in Section 2.3 of Reference 9.2.

2.2.3 Schematic diagram of SRP Station.



2.2.4 View of SRP Station.



3. INTERFERENCES AND LIMITATIONS

3.1 Avoid contamination of the SRP and guest instruments. Only clean, filtered gas should pass through the sample or reference manifolds.

3.2 Avoid overpressurization of guest instruments. Ensure that the sample and reference manifolds are vented to atmosphere. The guest instruments should be connected directly to the manifolds.

3.3 The sample lines should be initially conditioned with ozone. New sample lines may initially absorb ozone until properly conditioned and may bias the guest instrument's response.

3.4 Allow guest instrument to warm-up for 2 hours.

3.5 Allow guest instrument and SRP to stabilize at each ozone concentration level for a minimum of 20 minutes.

3.6 Ensure the flow from the Environics 9100 is greater than the sample flow rate of the guest instruments and SRP (5 lpm).

4. INSTRUMENTATION AND EQUIPMENT

4.1 SRP and support equipment.

4.2 Environics 9100 calibrator, ozone source.

4.3 Computer and monitor, with associated software.

4.4 Ultra pure grade air.

4.5 Teflon gas lines.

4.6 High accuracy barometer, for ambient pressure reading.

4.7 High accuracy thermometer, for ambient temperature reading.

5. PROCEDURES

5.1 Turn on guest instrument. Allow it to warm up for a minimum of 2 hours.

5.2 Connect sample line “O3A” or “O3B” to sample inlet port on back of instrument.

5.3 If instrument is a primary standard photometer, connect reference gas line “ZEROA” or “ZEROB” to reference leg of sample solenoid inside instrument. Some instruments require pressurized reference gas, use Teflon line labeled “PRESS AIR”.

5.4 Some primary standard photometers require a trial and error approach to operate. These instruments are designed to analyze ozone levels from a sample that the unit generates. The units output is insufficient for use on the SRP, requires at least 7 lpm sample flow. The operator must determine the photometer's sample and reference gas ports and connect the associated Teflon lines to them.

5.5 Obtain ambient pressure using the Barometer SOP.

5.6 Perform SRP Precheck procedure, see section 6.

5.7 Perform Instrument SOP, see section 7 for specific instrument model.

5.8 If Environics 9100 deenergized, perform following. If Environics 9100 energized and providing sample gas, go to step 5.6.

5.8.1 Turn power switch on Environics 9100 to “ON” position.

5.8.2 Turn on the black zero air toggle valve at back of the Environics 9100. (Up is the “OPEN” position).

5.8.3 Set the house air regulator supplying air to the Environics 9100 to 35 psi.

5.8.4 On the Environics 9100, select the “Flow Mode” from the menu screen. Enter “0.0” for the flow rate of mass flow controller (MFC) #1, “13.0” for MFC #2, and “0.0” for ozone concentration. The select “Update” on menu screen.

5.9 Set the service air regulator to 20 PSI on the Environics 9100 calibrator rack.

5.10 If not already performed, Login to network as “SRP” or user name obtained from network manager. Using the computer’s mouse, select “Start”, then “Run”. When prompted, enter “Command”. The computer will enter DOS mode.

5.11 Insert SRP #4 Data Diskette into floppy disk drive A.

5.12 At the DOS prompt, type "TP-ROUT**"** and press **Enter** to start the Dark Count (Scaler 1 = 7 & Scaler 2 = 12) and the Temperature & Pressure Monitoring routine. The entire routine will take approximately five minutes. After the twentieth data point is sampled a printout will be generated. Allow at least two cycles of 20 data points to display on screen before pressing the **F1** function key to exit the program. On the printer in the Environics 9100 calibrator rack, press "Online", then "Paper Feed", then "Online". Wait for printer to print results. Record the temperature, pressure, and scaler counts C1 & C2 of the SRP #4 on the test data sheet. Ensure the SRP stability by checking the standard deviation of scaler 1 (C1) and scaler 2 (C2) are less than 5 and the standard deviation of the ratio of C1/C2 is less than 0.00005. If these parameters are exceeded, re-enter "TP-ROUT" program and allow to stabilize. If stability criteria cannot be met, perform Section 7.1 of Reference 9.2.

5.13 At the DOS prompt, enter "CALEPA" then press **Enter** key. This will start the SRP operating system. (Approximately a three minute procedure)

5.14 Fill out the SRP #4 logbook. In each of the nine columns write the corresponding information as it pertains to the guest instrument. Initial the last column.

5.15 Type "1" and the **Enter** key to accept a recorded assay run.

5.16 Type "A" and the **Enter** key to store the run data on floppy disk drive A. If the SRP #4 data diskette has not been inserted in drive A do so now. Press the **SPACE BAR** to continue.

5.17 Type in the latest *numerical file number*. Follow the numerical date pattern display on the computer screen (Example 4940801A, first digit signifies the SRP #4, second & third the year (94), fourth & fifth the month (08), sixth & seventh the day (01), and the eighth digit (A) is the first run of that given day. The second run of the day would be represented by a (B) and so on for consecutive runs). Then press the **Enter** key to accept the file name. A .PRN file extension will be added automatically.
Note: Two instruments may be compared to the SRP simultaneously. However, only one instrument's data can be entered at a time. For the first run, enter the data for the instrument with the file number ending in A. At completion of comparison, the data for the second instrument can be entered.

5.18 Type in *your name* then press the **Enter** key.

5.19 Type in the *name of the guest agency* (owner of instrument), then press the **Enter** key to accept.

5.20 Type in the *number (#)* corresponding to the guest instrument. The number identifies the guest instrument as a transfer standard or primary standard. Then press the **Enter** key to accept.

5.21 Type in the *manufacturer's name and model number* of the guest instrument, then press the **Enter** key to accept.

5.22 Type in the *serial number (#)* of the guest instrument, then press the **Enter** key to accept.

5.23 Type in “verification” for primary standards or “certification” for transfer standards. certification. Then press the **Enter** key to accept.

5.24 Type in any additional comments about the guest instrument, if necessary. Do not use commas in the entry. Then press the **Enter** key to accept.

5.25 Review the entered information. Enter the number of the parameter you want to change, if any. Type “0” and press the **Enter** key to quit the edit screen. Otherwise, enter the number corresponding to the data to be edited.

5.26 Type in the number of replicates to be performed for each ozone concentration level. Typically, type “10”, then press the **Enter** key to accept.

5.27 Type in the number of concentration levels to be assayed. Typically, type “7”, then press the **Enter** key to accept (The seven concentration levels include the zero ppm level).

5.28 Type in the first generator setting as “0.0”, then press the **Enter** key. Ensure the target ozone level on the Environics 9100 is 0.0.

5.29 Turn the **ON** the Dwyer pump on the gas manifold box. Adjust each cell flow rate to 2000 cc/min using the adjustment valve on top of each respective rotameter.

5.30 Press the **SPACE BAR** to continue. The system will take preliminary concentrations. When the concentration is stable (approximately 20 minutes), press the **F5** function key while the word “READY” is present at the bottom of the computer screen (all entries are disabled while “OFF” is displayed). Press the **SPACE BAR** to begin taking data. The system will wait ten seconds before beginning. If the SPACE BAR is pressed again, the system will begin immediately. Take each of the ten sample readings from the guest instrument's display as the SRP updates it reading on the computer monitor. Record the instrument’s display in the appropriate line on the test data sheet (lines 1-10). Calculate the average of the instrument’s display, in ppm. Enter this value in the “Average” line of the test data sheet.

5.30.1 For the zero ozone level, enter “0.0” in the NetMeter line on the test data sheet. For subsequent ozone levels, subtract the instrument’s Average value from the zero ozone level’s Average and enter in the NetMeter line on the test data sheet. For instruments without temperature and pressure compensation, calculate the Corr.NetMeter value using the following equation.

$$\text{Corr.NetMeter} = \text{NetMeter}(760/P_a)(273.15 * T_a)/298.15$$

5.31 The computer screen will display the following: "THE REQUIRED DATA HAS BEEN OBTAINED FOR CONCENTRATION #1. ENTER THE CONCENTRATION FROM THE GUEST SYSTEM AND PRESS ENTER." Type in NetMeter, or Corr.NetMeter for non-temperature and pressure compensated instruments, value in ppb, and then press the **Enter** key to accept.

5.32 Record on the SRP ozone response in the True O_3 line of the test data sheet.

5.33 The computer screen will display the following: "SETUP THE OZONE GENERATOR FOR THE NEXT CONCENTRATION THEN ENTER THE NEXT GENERATOR SETTING." On the Environics 9100, enter the next ozone level, in ppm, in the Target Ozone entry screen, then press the **Update** selection.

5.33.1 For instruments operating in the 1 ppm range, use the following ozone levels: 0 ppm, 0.9 ppm, 0.09 ppm, 0.74 ppm, 0.26 ppm, 0.42 ppm, and 0.05 ppm.

5.33.2 For instruments operating in the 0.5 ppm range, use the following ozone levels: 0 ppm, 0.45 ppm, 0.045 ppm, 0.37 ppm, 0.13 ppm, 0.21 ppm, and 0.025 ppm.

5.34 Enter the targeted ozone level on the computer, in ppb. Then press the **Enter** key to accept.

5.35 Repeat steps 5.30 through 5.34 for each subsequent ozone concentration level. At the last ozone level, skip step 5.34.

5.36 After the last concentration level press the **SPACE BAR** to continue. Next the computer screen will display the following: "DO YOU WANT TO RETAKE ANY OF THE ORIGINAL DATA OR DO YOU WANT TO TAKE MORE DATA AT OTHER CONCENTRATIONS?" Press “Y” for yes or press “N” for no. Then press the **Enter** key to accept. If “Y” was selected, repeat steps 5.26 through 5.29, then return to this step.

5.37 The computer screen will display the following: "DO YOU WANT TO EDIT ANY OF THE GUEST SYSTEM VALUES?" Press “Y” for yes or press “N” for no. Then press the **Enter** key to accept.

5.37.1 If “Y” was selected, enter which concentration level to edit. Then press the **Enter** key.

5.37.2 Type in new instrument value. Then press the **Enter** key. Return to step 5.33.

5.38 The computer program will display the least squares linear regression equation for the guest instrument data. It will then display: "WOULD YOU LIKE TO SEE THE GRAPH?" Press “Y” for yes or “N” for no. Then press the **Enter** key to accept.

5.38.1 If “Y” was selected, the linear regression graph will be displayed. Press the **Esc** key to continue.

5.39 The computer screen will display the following: "DO YOU WANT TO COMPARE THE SAMPLE SRP CONCENTRATION WITH A SECOND GUEST SYSTEM?" Press “Y” for yes or press “N” for no. Then press the **Enter** key to accept.

5.39.1 If “Y” was selected, enter the second instrument’s data per steps 5.13 through 5.21 (skipping step 5.14).

5.39.2 The computer screen will display the following: "ENTER THE NEW CONCENTRATION FOR TRIAL 1." Type in the NetMeter or Corr.NetMeter value corresponding to concentration level 1 for the second guest instrument, in ppb. Then press the **Enter** key to accept.

5.39.3 Continue typing in the rest of the NetMeter or Corr.NetMeter values. After each concentration value, press the **Enter** key to continue.

5.39.4 Repeat steps 5.33 through 5.35, except the computer will display: "DO YOU WANT TO COMPARE THE SAMPLE SRP CONCENTRATION WITH ANOTHER GUEST SYSTEM?" Follow directions for step 5.35.

5.40 If you pressed “N”, the test is completed. The computer screen will display: "THE RUN HAS BEEN TERMINATED."

5.41 Allow guest instruments to run an additional 10 minutes. An additional post-zero level must be performed on the guest instruments only. Compare the post-zero Average with the pre-zero Average, this value should be within 5 ppb of the original zero point (less than 0.5% of full scale). If the criteria is exceeded, troubleshoot guest instrument. Most likely cause is a leak in the sample train.

5.42 Perform steps in Instrument SOP pertaining to collecting data for the instrument sample and control frequency. Enter data on test data sheet in appropriate lines for final results.

5.43 On computer, type “IMS” and press the **Enter** key to accept.

5.44 Scroll down to “10. Inst. Calibration”, and press the **Enter** key to accept.

5.45 Enter the ARB barcode number for the instrument, and press the **Enter** key to accept.

5.46 Enter the instrument log number and date of calibration. Press the **Enter** key to accept.

5.47 Enter “Y” if performed an instrument calibration, or “N” if other. Press the **Enter** key to accept.

5.48 The computer will display several datapoints. If the datapoints are correct, enter “Y”, or enter “N” to edit the datapoints. Press the **Enter** key to accept.

5.48.1 If enter “N”, edit values to match those targeted during the calibration. Enter “Y” after completing edits. Press the **Enter** key to accept.

5.49 Enter initial and final sample and control frequency values from test data sheet. Enter instrument temperature and pressure values, if temperature and pressure compensated. Enter SRP Scaler 1, Scaler 2, Pressure, and temperature values. Enter ambient pressure and temperature values from test data sheet. Press the **Enter** key to accept.

5.50 Enter "A" if instrument is a transfer standard or "P" if a primary standard photometer. Press the **Enter** key to accept.

5.51 Enter "P" if entering data in ppm, or "V" if entering data in volts. Press the **Enter** key to accept.

5.52 Enter instrument response from the **Average** line on the test data sheet (entered in ppm) and the SRP response from the **True O_3** line (entered in ppb). Press "Y" after all data entered correctly, or "N" to edit data. Press the **Enter** key to accept.

5.53 Print calibration data by selecting the first option. Press the **Enter** key to accept. Press the **Space Bar** to print results.

5.54 Print the certification results by selecting the second option. Press the **Enter** key to accept. If instrument results meets the certification criteria, press the space bar when prompted.

5.54.1 If instrument results does not meet the certification criteria, enter "Y" or "N" to print certification results. Press the **Enter** key to accept, and press the **Space Bar** when prompted. After printing results, skip step 5.51.

5.55 Print the instrument report by selecting the third option. Press the **Enter** key to accept, and press the **Space Bar** when prompted.

5.56 Press the Esc key twice, and quit the Instrument Management System by selecting the last option. Press the **Enter** key to accept.

5.57 At the Dos prompt, type "Exit" and press the **Enter** key to accept.

5.58 Log off the computer by selecting the **Start** key, select **Shutdown**, and select **Close all programs and log on as different user?**. Remove the SRP data disk from the A: drive.

5.59 On SRP control box, turn off pump.

5.60 If instrument certification or verification is complete, denenergize instrument. Disconnect power cable and sample lines. Cap the ends of the sample lines to prevent contamination.

5.61 The system is now in the standby condition. To completely shutdown system, perform the following steps.

5.61.1 Set the service air regulator to zero PSI on the Environics 9100 calibrator rack. Close the black zero air toggle valve on back on Environics 9100 (horizontal is the closed position).

5.61.2 On the Environics 9100's keypad, select the **Stop** key. Then select the **Exit** key. Turn power selector to **Off**. The system is now in the shutdown condition.

6. SRP PRECHECK PROCEDURE

6.1 Remove SRP data disk from computer. Turn on computer and monitor and allow it to boot up. Log into network using user name and password. Obtain user name and password from network administrator. Enter DOS by selecting the **Start** button, then the **Run** selection. Type in "Command", and press the **Enter** key to accept.

6.2 At the Dos prompt, type "TSTPG1" and press the **Enter** key to accept.

6.3 When prompted, type "1" and press the **Enter** key to accept.

6.4 Do not print the results by typing "N" when prompted, then press the **Enter** key to accept.

6.5 Allow the program to run for several minutes. Check that the following parameters are within specifications.

6.5.1 Dark count between 5 and 20. If dark count limits are exceeded, perform Section 7.2 of Reference 9.2.

6.5.2 Full counts between 70,000 and 100,000. If full count limit exceeded, perform Section 7.3 of Reference 9.2.

6.5.3 The pressure reading should be within 10 mbars of ambient. Use the following conversion to convert ambient pressure (in mmHg) to mbars.

Pressure (mbars) = Ambient Pressure (mmHg) x (1013.24/760)

If pressure limit exceeded, perform Section 7.4 of Reference 9.2

6.5.4 The temperature reading should be within 2 degrees Celcius of ambient temperature. If temperature limit exceeded, perform Section 7.5 of Reference 9.2.

6.6 Press the **F3** key to quit program.

7. INSTRUMENT SOP

7.1 General

7.1.1 The following instrument SOPs are for the most common models operated by the Standards Laboratory. For instruments not covered by the following SOPs, refer to the instrument's operation manual to obtain the following data: sample frequency, control frequency, sample temperature, sample pressure, and sample flow setting. Use a Vol-O-Flow meter to obtain actual sample flow rate.

7.2 DASIBI 1008-PC

7.2.1 Place the **Mode** selector switch to the **Sample/Temp** position. With the **T/P** switch in the **On** position, record the instrument's chamber temperature on the test data sheet.

7.2.2 Place the **T/P** switch in the **Off** position, record the instrument's sample frequency on the test data sheet.

7.2.3 Place the **Mode** selector switch to the **Control/Press** position. Record the instrument's control frequency on the test data sheet.

7.2.4 Place the **T/P** switch in the **On** position, record the instrument's pressure on the test data sheet.

7.2.5 Place the **Mode** selector switch to the **Operate** position.

7.2.6 Remove the instrument's cover panel, record the three **SPAN** thumbwheel settings on test data sheet.

7.2.7 Record the instrument's **ZERO** thumbwheel setting on the test data sheet.

7.2.8 Replace the instrument's cover panel.

7.2.9 Using a Vol-o-Flow flow meter, measure and record the instrument's sample flow rate on the test data sheet. Also record the flow rate setting on the instrument's rotameter.

7.3 DASIBI 5009-CP

7.3.1 Record the instrument's **Span** and **Offset** settings from thumbwheels on front panel onto the test data sheet.

7.3.2 Using the **DIAG.** thumbwheel, select diagnostics "3". Record the temperature and pressure readings on the test data sheet.

7.3.3 Using the **DIAG.** thumbwheel, select diagnostics "4". Ensure a numeric value is displayed. If not, check that the **T/P** switch is in the **On** position. If in **On** position, troubleshoot unit.

7.3.4 Using the **DIAG.** Thumbwheel, select diagnostics "5". Record the sample and control frequencies onto the test data sheet. The top value is the sample frequency, and the bottom value is the control frequency.

7.3.5 Return the **DIAG.** thumbwheel to "0".

7.3.6 Using a Vol-o-Flow flow meter, measure and record the instrument's sample flow rate on the test data sheet. Also record the flow rate measure on the instrument's rotameter.

7.4 DASIBI 1003-PC/AH

7.4.1 Record instrument **Span** and **Offset** settings from dials on front panel onto the test data sheet.

7.4.2 Using the mode selector switch, select the **Sample** setting. Allow unit to update the display several times and record value on the test data sheet.

7.4.3 Using the mode selector switch, select the **Cont.** setting. Allow unit to update the display several times and record value on the test data sheet.

7.4.4 Return the mode selector switch to **Operate**.

7.4.5 Using a Vol-o-Flow flow meter, measure and record the instrument's sample flow rate on the test data sheet. Also record the flow rate measure on the instrument's rotameter.

7.5 API 400/401

7.5.1 Using the **TST>** key, toggle until "Press = XX.X In-Hg-A" is displayed, record value as instrument's pressure reading on test data sheet.

7.5.2 Press the **TST>** key once, record value as instrument's flow setting on test data sheet.

7.5.3 Press the **TST>** key once, record value as instrument's temperature reading on the test data sheet.

7.5.4 Press the **TST>** key until the instrument's slope value is displayed. If instrument's slope does not display, then go to step 7.5.6. Record value as instrument's span setting on test data sheet.

7.5.5 Press the **TST>** key once, record the displayed value as instrument's offset setting on test data sheet.

7.5.6 Skip step if values obtained by step 7.5.4 or 7.5.5. On instrument display, select **SETUP**. Select **MISC**. Select **O3**. Enter password "818". Select **Slope**. Record value on test data sheet. If instrument is a primary standard photometer, ensure value is 1.000. If slope is other than 1.000, record value and edit to display 1.000. Press **Exit**, then press **Offset**. Record value on test data sheet. If instrument is a primary standard photometer, ensure value is 0.000. If not, record value and edit the Offset to display 0.000. Press the **Exit** key three times.

7.5.7 Skip step if values obtained by step 7.5.6. Deenergize instrument and computer. Connect the RS-232 cable from computer serial port to back of instrument. Energize instrument and computer. Allow the computer of boot up. Log into network using user name and password. Using the mouse, select the **Start** icon, then the **Run** selection. Type "Command", then press the **Enter** key to accept. At the dos prompt, type "cd/", then press the **Enter** key. Type "cd pcplus" and press the **Enter** key. Type "pcplus" and press the Enter key. After progam is loaded, type "vo3_slope" and press the **Enter** key to accept. Record the displayed value on test data sheet. Type "vo3_offset" and press the **Enter** key to accept. Record the displayed value on the test data sheet. If instrument is a primary standard photometer, perform the next substep.

7.5.7.1 If displayed slope is not 1.000, type "vo3_slope=1.000" and press the **Enter** key to accept. If displayed offset is not 0.000, type "vo3_offset=0.000" and press the **Enter** key to accept. Press the **Alt** and **z** keys to exit. Enter "Y" to exit.

7.5.8 Using a Vol-o-Flow flow meter, measure and record the instrument's sample flow rate on the test data sheet.

8. QUALITY CONTROL PRACTICES

8.1 DAILY PRACTICES

8.1.1 Prior to each comparison, the TSTPG1 program is performed. This program displays the SRP's ambient temperature, ambient pressure, scaler 1, and scaler 2 readings. The readings subjected to the following limits. If any limit is exceeded, perform the associated check in Reference 9.2.

Temperature – within 2 degrees celcius of ambient temperature thermometer. See step 6.5.4.
Pressure – within 10 mbars of ambient barometric pressure. See step 6.5.3.
Scaler 1 & 2 – greater than 70,000 and less than 100,000. See step 6.5.2.

8.1.2 Prior to each comparison, the TP-ROUT program is performed. This program tests the stability of the SRP. Twenty readings of both scalers are analyzed. The standard deviation of scaler 1 and 2 must be less than 5. The standard deviation of the ration of scaler 1 and 2 must be less than 0.00005. See step 5.9.

8.2 QUARTERLY PRACTICES

8.2.1 An Advanced Pollution Instruments, model 400 (ARB barcode #20004767), is used as a control standard. This instrument is compared to the SRP on a quarterly basis. A control chart is derived from historical comparisons. From the control chart, warning and out of control limits are defined.

8.2.1.1 For warning limit violations, investigations are initiated into the quality of house air, parameters associated with the SRP using the TSTPG1 program, the stability of the SRP using the TP-ROUT program, and recently performed instruments historical data. If the mentioned checks do not reveal any causes, the warning limit violation can be considered as a shift in the control standard and the SRP may be used for instrument comparisons.

8.2.1.2 For out of control limit violations, no instrument comparisons are allowed until the cause is found. Perform all the checks associated with a warning limit violation. If no cause is revealed, a request for a comparison with another SRP should be made to the U.S. EPA. No further instrument comparisons should be made until the results of the SRP comparison is analyzed.

8.3 ANNUAL PRACTICES

8.3.1 A second SRP (SRP #7) is used to verify the proper operation of the SRP. Originally, the U.S. EPA was performing these verification annually. However, the SRP's historical accuracy and stability has allowed it to be verified on a biennial basis. The U.S. EPA ships SRP #7 and the Standards Laboratory performs the comparison. The Standards Laboratory strictly follows Section 9.0 of Reference 9.2 during the performance of the verification.

9. REFERENCES

9.1 Transfer Standards for Calibration of Air Monitoring Analyzers for Ozone. Technical Assistance Document, EPA-600/4-79-056 September 1979, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

9.2 Standard Operating Procedures and Recertification Procedures for EPA's Standard Reference Ozone Photometer. Draft Report, EPA Contract 68-D3-0029, Work Assignment 3-136. TRC Environmental Corporation, 6340 Quadrangle Drive, Suite 200, Chapel Hill, North Carolina, 27514 and National Institute of Standards and Technology (NIST), Chemical Science and Technology Laboratory, Gaithersburg, MD 20899.

APPENDIX A

DATASHEETS

Datasheet PESS 2001 – Non Temperature/Pressure Compensated Instruments

State of California-Air Resources Board
Ozone Transfer Standard Data Sheet

Log Number: _____ Date: _____/_____/_____

TRANSFER STANDARD (Non-Temp./Pres. Corrected)	**SRP 4**
Instrument Model : _____ Property No. : _____ Serial No.: _____ Samp. Freq. (KHz): _____(Ini) _____(Fin) Cont. Freq. (KHz): _____(Ini)_____(Fin) Air Flow:_____SLPM at _____ Flow setting Offset: _____ Span (Dial) :_____ Chamber Temp.: _____°C Analyzer [ ] Photometer [ ]	Temperature (T) : _____°C Pressure (P) : _____mb Scaler 1 (C1) : _____ Scaler 2 (C2) : _____ Atm. Pres. (P_A) :_____mmHg Atm. Temp. (T_A):_____°C File No. : _____

AIR FLOW									
O_3 Generation									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Average (ppm)									
NetMeter (ppb)									
Corr.NetMeter									
True O_3 (ppb)									

$$\text{True } O_3 = \frac{(1013.25 \text{ mbars})(273.15 + T)(109)}{(89.65 \text{ cm})(308.32)(273.15)(P)} \ln \frac{I_O}{I}$$

Corr. Net Meter = Net Meter * $[760/P_A]$*$[273.15+T_A]/298.15$ = Net Meter * _____

Linear Regression: Net Meter = _____* (True O_3) _____

Corr. Coefficient = _____

COMMENTS: _____

_____

Calibrated by: _____ Checked By:_____

PES2001/June 1999

Datasheet PESS 2002 – Temperature and Pressure Compensated Instruments

State of California-Air Resources Board
Ozone Transfer Standard Data Sheet

Log Number: _____ Date: _____/_____/_____

Transfer Standard (Temp./Pres. Corrected)	U.V. Photometer No.4
Instrument Model:_____ Property No. :_____ Serial No.:_____ Samp. Freq.(KHz):_____(Ini) _____(Fin) Cont. Freq. (KHz):_____(Ini) _____(Fin) Air Flow:_____SLPM at _____Flow Setting Offset:_____Span (Dial):_____ Chamber Temp.:_____°C Chamber Pres.:_____atm Analyzer [ ] Photometer [ ]	Temperature(T):_____°C Pressure(P):_____mb Scaler 1:_____ Scaler 2:_____ Atm. Pres. (P_A):_____mm Hg Atm. Temp.(T_A):_____°C File No.:_____

Air Flow									
O_3 GENERATION									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
Average (ppm)									
NetMeter (ppb)									
True O_3 (ppb)									

$$\text{True } O_3 = \frac{(1013.25 \text{ mbars})(273.15 + T)(10^9)}{(89.65 \text{ cm})(308.32)(273.15)(P)} \ln \frac{I_o}{I}$$

Linear Regression: Net Meter =_____* (True O_3) _____

Corr. Coefficient =_____

COMMENTS:_____

Calibrated by:_____ Checked by:_____

PES2002/July 1999